ASTRA's *2008 State R&D Sheets* Now Available for Download
(details at www.usinnovation.org and www.aboutastra.org)

ASTRA Briefs

Vol. 7, Nos. 1-3 *"Serving the Physical & Mathematical Sciences and Engineering"* *Spring 2008*

Efforts to Salvage FY '09 Science Budgets Underway

President Bush Submits FY 09 Budget: An Analysis

by Kei Koizumi, American Association for the Advancement of Science

On February 4, President Bush released his proposed budget for fiscal year (FY) 2009. The $3.1 trillion budget projects a deficit exceeding $400 billion next year, despite excluding most 2009 war costs and holding domestic spending flat. Within a flat domestic budget, the 2009 budget

(continues on page 2)

ASTRA "Rising Tide" Study Delivered to Campaigns, Activist Groups

ASTRA's ***"Rising Tide"*** policy framework document has been delivered to all remaining Presidential Campaigns and many Hill Offices. The nonpartisan study details what ASTRA thinks should be done over the next decade in critical policy areas. It suggests ways in which the U.S. can compete successfully in a changing global economy. *Details, page 13.*

ASTRA-CSIS Educational Programs on Innovation Well Received

The **Center for Strategic & International Studies (CSIS)** and ASTRA are holding more innovation policy programs, following a recent session: **"Innovation & Education: Are we Investing Well?"** The general public can receive materials from this event free of charge. *Details on page 15.*

Dr. Good Testifies at NIST FY '09 Budget Hearing

ASTRA's Chairman, Dr. Mary Good, testified on the FY 2009 Budget of the **National Institute for Standards & Technology (NIST)** on March 11. Good also critiqued current Administration plans to eliminate the **Technology Innovation Program (TIP)** and the **Manufacturing Extension Partnership (MEP) Program.** *Details, pages 15-17.*

ASTRA, Allies Urge Added Science Funding in FY 2008 Defense "Supplemental" Spending Bill

ASTRA and allied groups are urging Congress to consider additional science funding in the **FY '08 Supplemental Department of Defense (DOD) spending bill**. *Details, page 18,*

230 Constituents, 386 Meetings & 40 States = Congressional Visits Day 2008

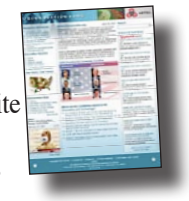
The **Science, Engineering and Technology Working Group (SET-WG)** completed its successful Washington advocacy event on **March 4-5, 2008** through the **Congressional Visits Day 2008** annual program. *Details & Photos, pages 19-22.*

ASTRA Legislative Task Force Meets

ASTRA's **Legislative Task Force** has been meeting over the past several months, and working with other coalitions on key initiatives related to scientific research funding. Sign-on letters and Hill visits have been frequent. Task Force members admit that this year's budget scenario is frustrating.

They anticipate a repeat of last year's impasse over science spending — for reasons unrelated to a dire need for increases. The upcoming general election, the federal deficit and the economic slow-down loom over most budget politics. *Details, page 18.*

ASTRA Web Site Traffic Soars — Presidential Campaign Tracking a Hit



In its first five months of existence, ASTRA's **usinnovation.org** Web Site has increased visitors by 71%, with unique visitors increasing by 67%. During February, 2,374 first time visitors returned to the site for 902 repeat visits.

The most popular pages remain the **Presidential Campaign S&T Tracking** page, and the **State R&D** pages. For the **www.aboutastra** Site, visitors have increased to more than 4,700 per month on average. The Web Sites are crucial investments in ASTRA's advocacy and media strategies. *Details, page 13.*

(continued from page one) continues to propose large increases for the three physical sciences agencies in the American Competitiveness Initiative (ACI), increases for human spacecraft development, flat funding for biomedical research in the National Institutes of Health (NIH), and mostly increases in other parts of the federal research and development (R&D) portfolio but cuts for key agricultural and environmental R&D agencies. Defense R&D would continue to increase, and next year defense basic research in the physical sciences would share in the gains. Despite tough budget conditions, the overall federal investment in R&D would increase $4.6 billion or 3.3 percent to $145.4 billion, driven primarily by increases in development funding. The federal investment in basic and applied research would fall 0.5 percent to $57.1 billion in 2009 as proposed gains in the ACI agencies would be offset by cuts in other agencies' research funding, primarily cuts in congressional earmarks. In real terms, the federal investment would fall 9 percent in inflation-adjusted dollars between 2004 and 2009.

R&D in the FY 2009 Budget: Physical Sciences Remain a Top Priority

In its broad outlines, President Bush's proposed budget for FY 2009 once again offers the same themes as in previous years: big increases for defense and homeland security, trims in some entitlement programs, extensions of expiring tax cuts, and plans to reduce the budget deficit primarily by cutting domestic discretionary spending and by not budgeting for future war costs. There is also continuity in the President's proposals for the federal R&D portfolio: despite appropriations setbacks, the budget stays on track with the third year of the American Competitiveness Initiative (ACI) vision of doubling between 2006 and 2016 the budgets of the National Science Foundation (NSF), the Department of Energy (DOE) Office of Science, and the National Institute of Standards and Technology (NIST) laboratories in Commerce.

The three research-oriented ACI agencies lead the pack in R&D gains (see Figure 1), followed closely by proposed gains for development programs in DOE, the National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD). But in other areas of the federal R&D portfolio, cuts in past budgets turn into requested increases this time around. While biomedical research in the National Institutes of Health (NIH) would remain flat, in a tight domestic budget most other R&D funding agencies would see gains, especially when congressional earmarks, which are absent in the President's request, are excluded from the 2008 funding level to allow for non-earmarked 2008 to 2009 comparisons (see Figure 1). As a result, most federal R&D agencies would see real increases for their R&D programs if the budget is enacted, although there would be cuts to agricultural and environmental R&D agencies.

(All figures in this release are preliminary and will be revised in later AAAS releases with revised agency data. FY 2008 and FY 2009 figures exclude pending war-related supplementals. In many cases, AAAS revisions made

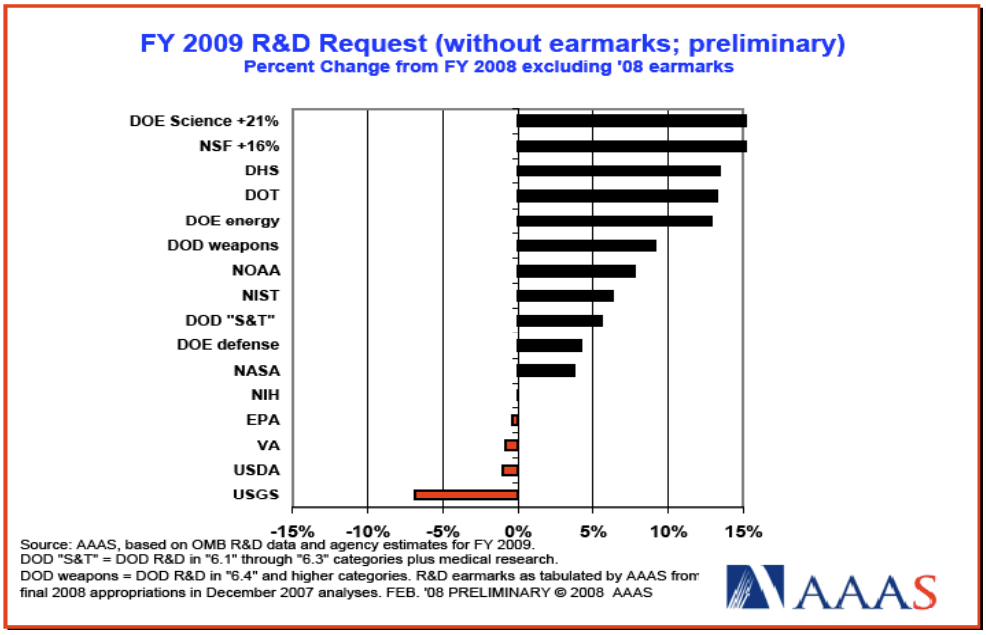


Figure 1

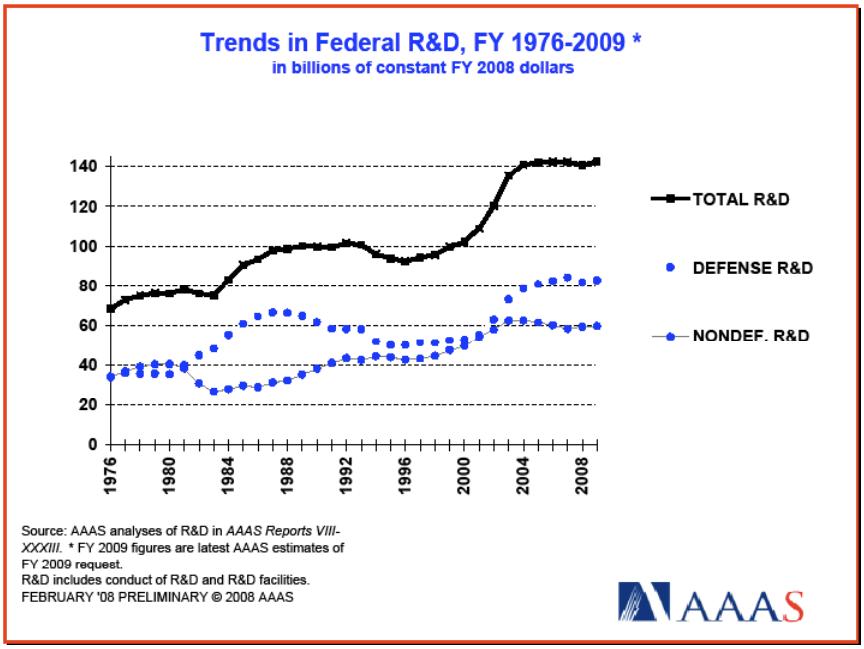


Figure 2

for this analysis and forthcoming revisions result in funding trends that differ significantly from funding trends reported in the President's budget documents. Funding trends describing earmarks are based on the January 2008 AAAS analysis of R&D in final 2008 appropriations.)

The proposed federal R&D portfolio in FY 2009 is a record $145.4 billion, $4.6 billion or 3.3 percent above this year's current funding level (see Figure 2). Once pending war-related supplementals for DOD development in 2008 and 2009 are added, federal R&D totals for both years will climb even higher. Once again, development funding would hit a new high of $84.0 billion (up $4.5 billion or 5.7 percent) because of large increases for DOD weapons and NASA spacecraft development. R&D facilities funding would gain 9.3 percent to $4.3 billion because of large increases for NASA's International Space Station and DOE Science support on projects such as the International Thermonuclear Experimental Reactor (ITER).

- Total federal support of research (basic and applied) would fall 0.5 percent or $282 million to $57.1

billion, even after large proposed increases for physical sciences and related research in NSF, DOE's Office of Science, and NIST (see Figure 3). Removing 2008 congressional earmarks from the new budget request ($1.1 billion in research earmarks for DOD alone) accounts for the cut; excluding earmarks from the 2008 base, federal research spending in 2009 would increase by enough to keep pace with expected inflation of 2.0 percent. NIH research funding would stay exactly flat at $28.5 billion, while most other agencies would see gains in non-earmarked research funding. In real terms, the federal research portfolio would be down 9.4 percent from 2004.

President Bush's American Competitiveness Initiative (ACI) would once again be the big winner among domestic programs. The three ACI agencies (NSF, NIST laboratories, DOE Office of Science) would collectively receive $12.2 billion in the 2009 budget, a 15 percent increase over this year.

The NSF budget of $6.9 billion would be a 14 percent increase, with increases approaching 20 percent for the Mathematical and Physical Sciences (MPS), engineering and computer science directorates and smaller increases for non-physical sciences directorates. DOE's Office of Science request for $4.7

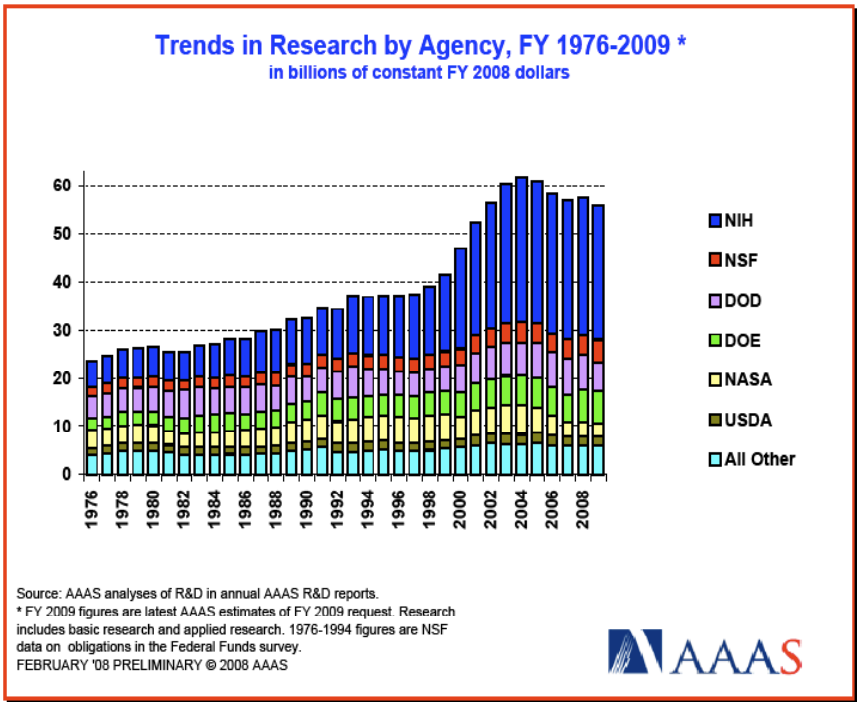


Figure 3

billion would be a 19 percent increase restoring funding for ITER, physics, and other basic research projects hard hit by the 2008 appropriation. And the NIST labs would receive a large increase, though at the cost of proposed eliminations of NIST's external programs (the Technology Innovation Program and the Hollings Manufacturing Extension Partnership). In a surprising development, DOD requests a 4 percent increase in its basic research ("6.1") portfolio to $1.7 billion, a 16 percent boost if earmarks in the 2008 base are excluded. DOD is a key sponsor of the physical sciences, but until now physical sciences advocates have been unsuccessful in convincing DOD to boost this investment.

The National Institutes of Health (NIH) would receive exactly the same amount ($29.5 billion) in 2009 as in 2008; nearly all of NIH's institutes and centers would also get the same budgets as this year. Several biomedical research advocacy organizations have already decried the 2009 proposal for leaving NIH 13 percent below the 2004 funding level after adjusting for biomedical research inflation. The number of new grants, the average real size of a grant, and the expected success rate for grant competitions are all expected to fall in 2009.

NASA R&D would increase to fund the development and construction of new human spacecraft. NASA R&D, in preliminary figures, would gain 2.9 percent to $10.7 billion, but the entire increase and more would go to two big projects: finishing the International Space Station and developing the Crew Launch Vehicle and Crew Exploration Vehicle combination. As a result, NASA support of research in the physical sciences, environmental sciences, aeronautics, and other disciplines would fall once again.

Nondefense R&D would increase 2.7 percent to $60.9 billion, far better than the flat funding requested for all nondefense discretionary programs and well ahead of the 2.0 percent expected inflation rate (see Figure 2). Boosts for the ACI and space vehicles development help to offset requested cuts to earmarks and other smaller nondefense R&D programs and flat funding for NIH R&D, but overall the nondefense portfolio continues to be flat or declining since peaking in 2004 (see Figure 2).

Most R&D agencies would see increases in 2009, especially if congressional earmarks are excluded (see Figure 1). While R&D in the U.S. Department of Agriculture (USDA) would decline 1 percent even when $369 million in 2008 R&D earmarks are not counted, and Environmental Protection Agency (EPA) R&D and U.S. Geological Survey (USGS) R&D would fall 1 percent and 7 percent, respectively, because of proposed program cuts, most other R&D funding agencies would see gains ahead of expected inflation.

Even DOE's energy R&D programs, coming off extraordinary congressional and requested increases in 2008, would gain another 4.1 percent to reach $2.4 billion and the Department of Homeland Security (DHS) would rebound from budget troubles in recent years with a 4.5 percent gain to $1.1 billion (see Table 1) that becomes a 13 percent boost without 2008 earmarks.

Defense R&D continues to climb to record levels in wartime, and will be boosted further in both 2008 and 2009 when billions of dollars in war-related supplemental funds are enacted later this year. Total defense R&D would reach $84.5 billion in 2009, up 3.7 percent over FY 2008.

Although the total in real terms would be off slightly from the record 2007 funding level (see Figure 1), both 2008 and 2009 are likely to hit all-time highs after supplementals are enacted. DOD weapons systems development would increase dramatically by $4.5 billion or 6.9 percent to a new high of $69.0 billion, but once again there would be steep cuts in DOD's S&T (DOD "6.1" through "6.3" plus medical research) programs because of the proposed elimination of earmarks. DOD S&T would plummet 11.7 percent to $11.7 billion, but would increase 5.6 percent if 2008 earmarks are excluded (see Figure 1). DOD basic research would do especially well with $1.7 billion, a 4 percent increase that becomes a 16 percent increase if earmarks are excluded.

The Administration priorities of basic physical sciences, space exploration, and defense development show up clearly in the federal R&D portfolio by mission. The priority missions would all receive large increases, while R&D for most other national missions would gain modestly.

Proposed ACI boosts to the DOE Office of Science and NSF make up the 15.3 percent gain for general science R&D to $10.2 billion, while the NIST labs' increase offset partially by NIST extramural cuts would boost commerce R&D by 4.6 percent. Space-related R&D would gain 3.7 percent to $10.3 billion, entirely from gains in development funding of new space vehicles instead of the broader space R&D portfolio.

R&D for other national missions including agriculture (down 17 percent) and the environment (down 4 percent) would fall primarily from the proposed elimination of earmarks. Energy R&D would gain 4.1 percent to $2.5 billion after nearly doubling in 2008. Funding for health

R&D, the largest nondefense mission, would increase slightly by 0.5 percent to $30.8 billion because of flat funding for NIH and Department of Veterans Affairs (VA) R&D combined with a large increase in biodefense countermeasures R&D in the Department of Health and Human Services (HHS) to $250 million.

- Federal homeland security-related R&D would gain 10.2 percent to $5.5 billion in FY 2009, a gain of $512 million reflecting a budget proposal that favors defense spending, and homeland security over most other domestic priorities. The majority of the multi-agency portfolio remains outside the Department of Homeland Security (DHS), with the largest part in NIH for its biodefense research portfolio.

NIH's portfolio, mostly in the National Institute of Allergy and Infectious Diseases (NIAID), would total $1.9 billion in FY 2008 (up 1.0 percent). The largest domestic increase would be a $250 million allocation (more than double the $102 million this year) in the Biomedical Advanced Research and Development Authority (BARDA) for R&D on biomedical countermeasures. DOD would continue to increase spending on homeland security-related activities with $1.5 billion, up 16 percent, primarily in Defense Agencies such as the Chemical and Biological Defense Program (CBDP) and the Defense Threat Reduction Agency (DTRA) but with the largest 2009 increase coming from the Air Force. Large increases would also go to food safety research in USDA and decontamination and drinking water protection projects at EPA.

President Bush's FY 2009 budget now goes to Congress where the R&D requests will go through the appropriations process. Democratic appropriators have reorganized appropriations jurisdictions into 12 bills, 10 of which fund some R&D. As in the past, 95 percent of the federal R&D portfolio will be appropriated through 4 appropriations bills.

Multi-agency initiatives on nanotechnology, information technology, and climate change science would all do well in the 2009 budget because of the emphasis on the physical sciences in the ACI and a generally solid R&D budget request.

Climate Change Science Program (CCSP) funding would climb above $2 billion for the first time since 2003 with a 9.6 percent or $177 million increase to $2.0 billion thanks to environmental sciences programs at NSF and DOE Science benefiting from ACI-inspired increases for these agencies and also thanks to a restructuring of NASA spending to boost spending on the earth sciences and especially satellite-based observations of climate change within a shrinking NASA research portfolio. After several rough years, NASA contributions to the CCSP would rebound with a $126 million or 11.7 percent increase to $1.2 billion in 2009. Squarely in the mainstream of the physical sciences, the Networking and Information Technology R&D initiative would enjoy a 6.2 percent increase to $3.5 billion because of surging requests for two of its key sponsors, NSF and DOE Science. And the National Nanotechnology Initiative would benefit from ACI increases for NSF, DOE Science, and NIST to reach $1.5 billion (up 2.4 percent), partially offsetting steep cuts in DOD's contributions.

The "Federal Science and Technology" (FS&T) budget, an alternative measure of the federal investment in science and technology, would decline $159 million or 0.3 percent to $61.8 billion because of the proposed elimination of 2008 earmarks in 2009. The collection of mostly R&D programs along with education, human resources, and other non-R&D programs, is designed by the Office of Management and Budget (OMB) to offer another indicator of federal funding for research-oriented programs. Combined funding for the ACI agencies, a subset of the FS&T budget, would be $12.2 billion in 2009, a dramatic increase of 15.0 percent or $1.6 billion when most other FS&T programs would decline.

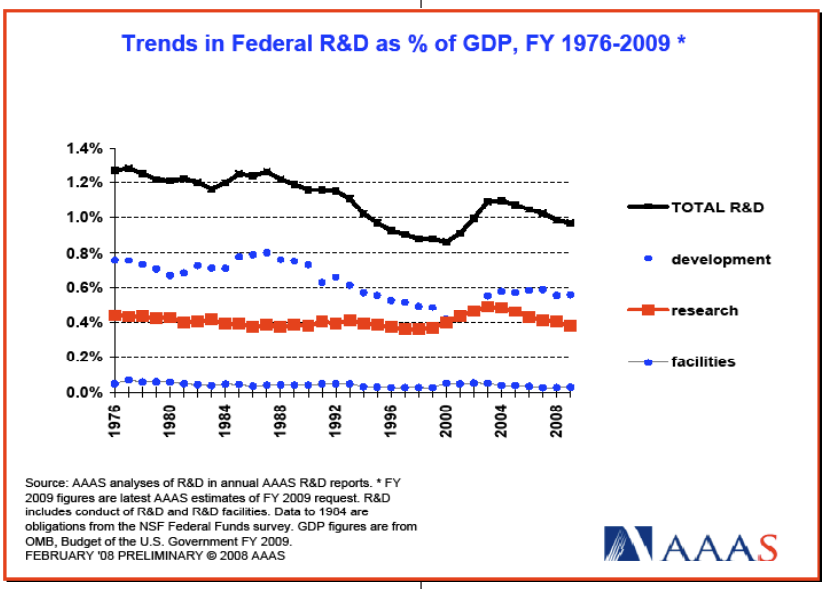


Figure 4

The FY 2009 R&D Budget in Historical Context

Although high-priority investments in physical sciences research, weapons development, and human space exploration help to keep the federal R&D outlook brighter than the bleak outlook for domestic programs overall, the FY 2009 budget continues the recent trends of declining federal support for research.

The federal investment in basic and applied research would fall in real terms (see Figure 3) if the FY 2009 budget is enacted, continuing a downward slide that began after 2004. Federal research did very well between 1998 and 2003 because of the campaign to double the budget of NIH, the largest federal supporter of research.

Other agencies also increased their research investments in that time period because a string of budget surpluses freed up resources for domestic appropriations. But with the return of budget deficits in 2002 followed by restraints on domestic spending thereafter, growth in research funding for NIH and other domestic agencies slowed in 2004 and then reversed. At the same time, DOD research support lagged as the Pentagon went to war in 2003 and shifted resources away from research toward near-term projects, and NASA research fell even within a stable R&D budget as it shifted resources from research to development.

As a result, federal support for research is now in decline, with potential gains in the physical sciences more than offset by eroding support for biomedical research and other disciplines. The 2009 budget would continue the downward slide in federal research funding and leave the federal research portfolio 9.4 percent below the 2004 level in inflation-adjusted dollars. Federal research investments are shrinking as a share of the U.S. economy, just as other nations are increasing their investments.

As shown in Figure 4, the federal R&D investment exceeded 1 percent of U.S. Gross Domestic Product (GDP) until recently, buoyed by big increases in weapons development, but is now declining sharply. Federal investments in development, mostly in DOD, have held steady as a share of the economy, but the federal research/GDP ratio is in free fall down to a projected 0.38 percent in 2009, below the long-term historical average of 0.4 percent after gains in the late 1990s.

Despite an increasingly technology-based economy and a growing recognition among policymakers that federal research investments are the seed corn for future technology-based innovations, the U.S. government research investment has so far failed to match the new realities despite the rallying points of innovation and the American Competitiveness Initiative, and has also failed to match the competition. Asian nations are dramatically increasing their government research investments: both China and South Korea, for example, are boosting government research by 10 percent or more annually.

Highlights of the Major R&D Funding Agencies

(Complete coverage of the major R&D funding agencies will be available in the forthcoming AAAS Report XXXIII: R&D FY 2009 and on the AAAS R&D web site in agency updates. All figures in this analysis are preliminary, and will be revised in later releases.)

The National Institutes of Health (NIH) would receive exactly the same amount in 2009 as in 2008, a total of $29.5 billion (up 0.0 percent). Most of NIH's institutes and centers (IC's) would see their budgets remain flat for the fifth year in a row, with no allowance for inflation. NIH R&D would also remain flat, at $28.6 billion (up 0.0 percent). In 2009, there would be fewer new research grants than in 2008, the real size of the average research grant would shrink for the fifth year in a row, and the

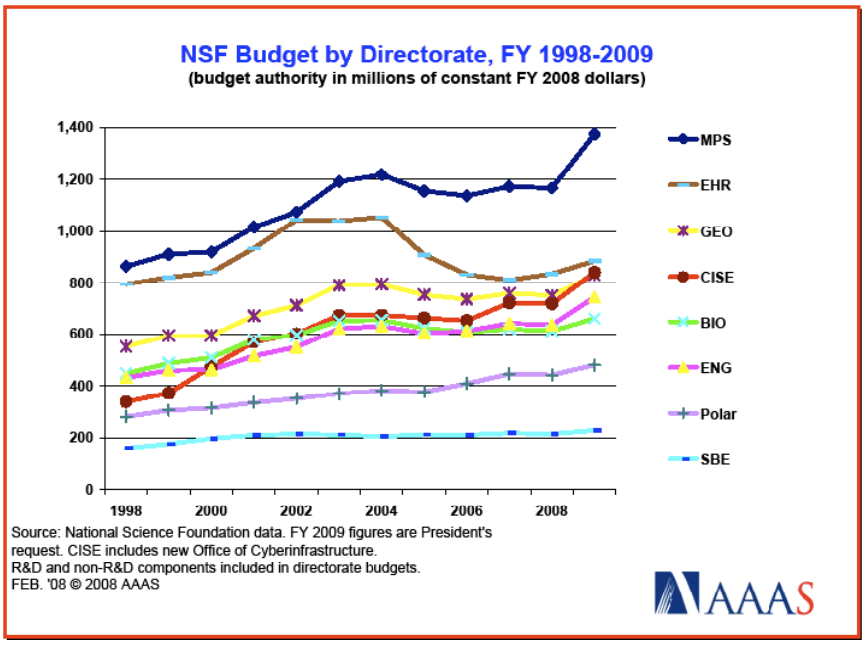


Figure 5

success rate for grant competitions would fall again to 18 percent. After peaking in 2004, the NIH budget has declined every year in real terms, and if enacted the 2009 request would leave NIH funding 8 percent below 2004 after adjusting for economy-wide inflation and 13 percent below 2004 after adjusting for NIH's own calculations of biomedical research inflation.

With the budget freeze, there would be few new initiatives; the only growth area would be the NIH Common Fund (NIH Roadmap) in the Office of the Director with a $534 million request (up 8.8 percent), offset by the proposed cancellation of a $92 million children's health research study. Elsewhere in the Department of Health and Human Services (HHS), the Biomedical Advanced Research and Development Authority (BARDA) requests $250 million for R&D on biomedical countermeasures, more than double the $102 million 2008 allocation.

The National Science Foundation (NSF) benefits from the Administration's American Competitiveness Initiative with a 13.6 percent boost for its total budget to $6.9 billion in 2009, an especially large increase designed to keep the agency on track to double its budget between 2006 and 2016.

NSF's R&D investments (excluding education, human resources, and overhead spending) would total $5.2 billion, a 15.5 percent increase to an all-time high in real terms. All of NSF's research directorates would receive large increases in 2009 after flat funding in 2008, and all would recover from budget cuts after 2004 to reach all-time highs in inflation-adjusted dollars (see Figure 5). The 2009 NSF request clearly favors the physical sciences, with requested increases approaching 20 percent for the Mathematical and Physical Sciences (MPS; up 20 percent), Engineering (ENG; up 19 percent), and Computer and Information Science and Engineering (CISE; up 20 percent) directorates. The Biological Sciences (BIO; up 10 percent), Geosciences (GEO; up 13 percent), and especially the Social, Behavioral and Economic Sciences (SBE; up 9 percent) directorates would lag behind but would narrowly manage to match past funding levels (see Figure 5). NSF's education and human resources programs would gain 9 percent to $790 million.

The Department of Defense (DOD) R&D investment continues to grow, with a proposed increase of $2.9 billion or 3.7 percent to $80.7 billion in 2009, but both the 2008 and 2009 totals will grow by billions later this year when war-related supplementals are added.

In a surprise move, DOD requests a 4.0 percent increase to $1.7 billion for its basic research ("6.1") portfolio, the majority of which is performed in universities. Taking out $165 million in 2008 basic research earmarks results in a remarkable 16 percent increase for "6.1" between non-earmarked 2008 funding and the 2009 request. "6.1" funding in all three military services and the Defense Agencies would gain, with particularly large increases in Navy and Air Force basic research.

For the past several years, science and engineering advocates have pressed DOD, a key sponsor of the physical sciences, to join efforts such as the ACI to increase federal physical sciences funding. "Science and Technology" (S&T), which includes basic research and also applied research, medical research, and technology development, would fall 11.7 percent to $11.7 billion, but entirely because DOD would not renew $2.2 billion in 2008 S&T earmarks. Excluding 2008 earmarks, DOD "S&T" would gain 5.6 percent between 2008 and 2009 (see Figure 2).

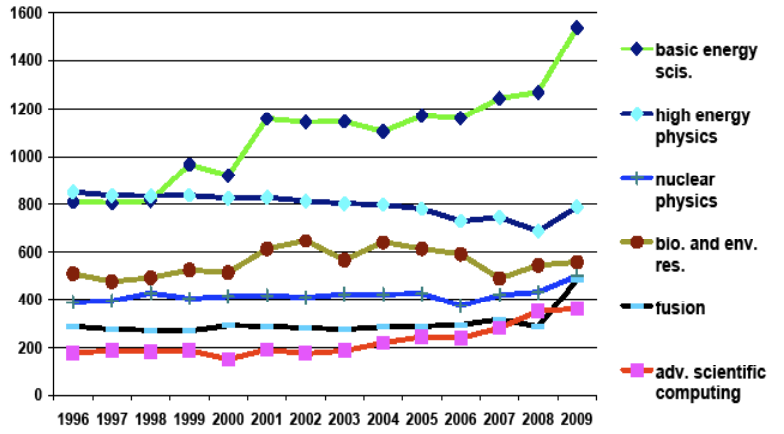
The research-oriented Defense Advanced Research Projects Agency (DARPA) would do spectacularly well with a request of $3.3 billion, an 11 percent increase. DOD weapons development would increase dramatically by 6.9 percent or $4.5 billion to an all-time high of $69.0 billion.

The National Aeronautics and Space Administration (NASA) budget would grow $497 million or 2.9 percent to $17.6 billion in 2009, with the entire increase and more going to two big-ticket human space programs.

The Constellation Systems program to develop the next generation of human spacecraft would receive $3.0 billion, an increase of 23.3 percent or $576 million, including a billion dollars each for the Crew Exploration Vehicle and the Crew Launch Vehicle. The International Space Station would receive $2.1 billion, a $247 million or 13.6 percent increase, as construction ramps up toward completion. But increases for these two programs would leave NASA's research-oriented programs in decline once more.

The Science portfolio would fall 5.6 percent to $4.4 billion after a modest gain in 2008, with especially steep cuts for the Astrophysics (down 13 percent) and Heliophysics (down 31 percent) portfolios because of the winding down of several large missions including the Hubble Space Telescope. Planetary Science (up 7 percent) and Earth

DOE Office of Science Programs, FY 1996-2009
(budget authority in millions of constant FY 2008 dollars)



Source: AAAS Reports on R&D, various years, and DOE historical budget documents. Adjusted for inflation using OMB's GDP deflators. BES includes Spallation Neutron Source funds. BER includes earmarks for most years (not 2007 through 2009). FY 2009 figures are the budget request.
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Science (up 7 percent) would receive boosts, however, with a special emphasis on new earth science missions. Aeronautics research funding would continue to tumble with a 13 percent cut to $447 million. Preliminary figures show the NASA R&D portfolio increasing 2.9 percent to $10.7 billion (see Table 1), but there are several anomalies in the data related to an extensive restructuring of NASA budget accounts, and the R&D totals are far lower than in previous years. The NASA R&D data are likely to be revised extensively in coming weeks.

The Department of Energy (DOE) R&D portfolio would soar 8.4 percent to $10.6 billion because of continuing Administration support for DOE's Office of Science (OS) as part of the American Competitiveness Initiative (ACI). DOE Science would be a clear winner with a 18.9 percent proposed increase to $4.7 billion for its total budget, in an effort to keep the office on track to double its budget between 2006 and 2016 after appropriations setbacks the last two years. R&D in DOE Science would be $4.3 billion, up 16.7 percent, but excluding 2008 earmarks the increase would be 21 percent (see Figure 2). Most Science programs would receive substantial increases to hit historic highs (see Figure 6), but these gains depend crucially on the outcome of 2009 appropriations.

After a significant hit in 2008 that deleted the U.S. contribution to the multi-national International Thermonuclear Experimental Reactor (ITER) project, fusion research would total $493 million, up 72 percent, including a $215 million ITER contribution for 2009. Basic Energy Sciences (BES) would dominate the portfolio with $1.6 billion, up 24 percent. The High-Energy Physics program would try to recover from sharp cuts in 2008 with a 17 percent boost to $805 million, while Nuclear Physics would gain 18 percent to $510 million. DOE's energy R&D would total $2.4 billion, a 4.1 percent gain after an enormous congressional increase in 2008. Investments in renewables such as biomass and nuclear energy would continue to gain. Coal R&D would soar 26 percent to $624 million, including a 25 percent boost to $149 million for carbon sequestration research and a doubling of funding for the recently restructured FutureGen project to $156 million. But DOE once again proposes to eliminate R&D on gas and oil technologies, and proposes to cancel $50 million in mandatory funding for a deepwater oil and gas exploration R&D program.

The Department of Homeland Security (DHS) R&D portfolio fell sharply in 2007 because of congressional dissatisfaction with the new department's R&D efforts, but has since steadied and would gain slightly in 2009 to $1.1 billion (up 4.5 percent. The R&D increase would be 13 percent excluding a bumper crop of 2008 R&D earmarks (see Figure 2). Research on radiological and nuclear countermeasures would continue to gain (up 3.3 percent to $334 million) in the Domestic Nuclear Detection Office (DNDO), while chemical and biological countermeasures R&D in the Science and Technology Directorate would fall. University Programs funding would fall from $49 million in 2007 and 2008 down to $44 million in 2009. In addition, DHS will receive $2.2 billion in already-appropriated funds for Project Bioshield in 2009, to procure promising biodefense countermeasures from the private sector.

R&D in the U.S. Department of Agriculture (USDA) appears to fall a dramatic 15.5 percent in 2009 to $2.0 billion (see Table 1), but as in past years the requested cut is due to the proposed elimination of congressional earmarks. Congress is likely to add back earmarks in 2009 appropriations. Excluding earmarks from the 2008 base, USDA R&D would decline just 1.0 percent between 2008 and 2009 (see Figure 2). On the extramural

side, the National Research Initiative (NRI) of competitively awarded research grants would increase $66 million to a record $257 million, although similar proposed increases in past years have not made it through Congress. Hatch Act funding would fall from $196 million to $139 million. USDA intramural research would fall $84 million to $1.0 billion, but the cut would become a small increase after adjusting for 2008 earmarks.

The National Institute of Standards and Technology (NIST) laboratories in the Department of Commerce would benefit from the ACI. NIST intramural research would climb 20.7 percent to $446 million, while intramural construction funding would also gain.

But the Bush Administration once again proposes to eliminate NIST's extramural Technology Innovation Program (TIP), and would close out the non-R&D Hollings Manufacturing Extension Partnership with a $4 million request. In order to restore funding for the extramural programs, Congress is likely to trim the requested increases for intramural programs. Total NIST R&D would increase 6.1 percent to $545 million. Also in Commerce, National Oceanic and Atmospheric Administration (NOAA) R&D would fall slightly to $582 million, but after taking out 2008 earmarks the 2009 increase for core NOAA research programs would be 8 percent (see Figure 2).

The Department of Veterans Affairs (VA) would maintain a flat R&D budget of $884 million in FY 2009 after large gains in 2007 and 2008 from emergency supplemental appropriations.

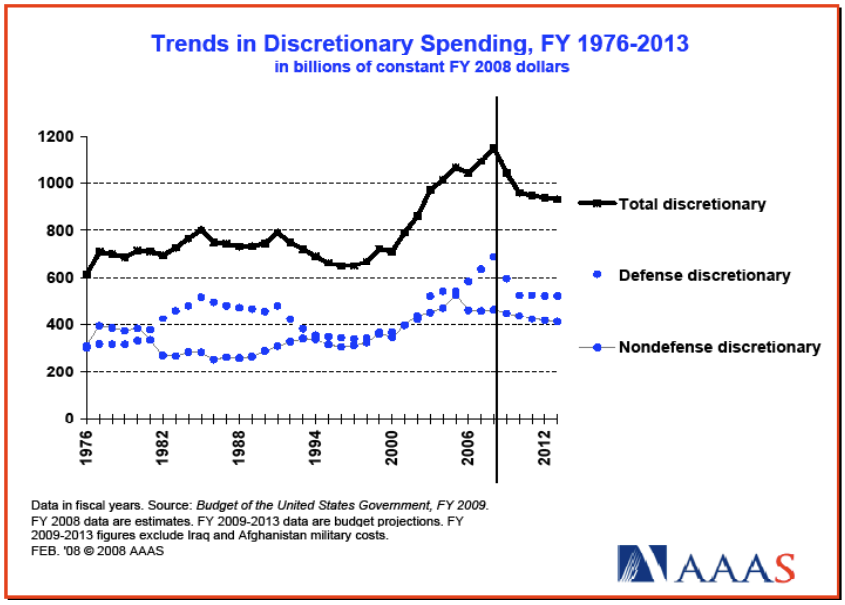


Figure 7

R&D in the Department of the Interior would fall 9 percent to $617 million, with a similar 7.0 percent cut to $545 million for R&D in Interior's lead science agency, the U.S. Geological Survey (USGS). The cuts would, as in previous requests, be concentrated in USGS' mineral resources and water resources R&D, with modest increases or flat funding for other R&D priorities.

The Environmental Protection Agency (EPA) R&D portfolio of $550 million in 2009 would be a 1.3 percent cut from 2008, with cuts to most research areas partially offset by increases for homeland security-related research.

Department of Transportation (DOT) R&D funding would increase 9.5 percent to $901 million because of large requested increases for aviation R&D in the Federal Aviation Administration (FAA) and continuing increases for highway R&D in the Federal Highway Administration (FHWA).

Budget Context and Outlook: Tough Choices for Congress

The President's 2009 budget projects deficits exceeding $400 billion for the next two years before balancing by 2012, though the budget reaches balance only through large proposed cuts in health care entitlements, an expanding reach for the Alternative Minimum Tax (AMT) to tens of millions of taxpayers, no war funding beyond early 2009, highly optimistic economic growth forecasts, and continuing real reductions in domestic discretionary spending.

In 2009, nondefense spending would be held flat with 2008, meaning a decline in inflation-adjusted terms with further cuts envisioned in future years (see Figure 7). Already, nondefense spending has been flat or declining in real terms since 2004 with only a few exceptions for Hurricane Katrina, veterans, and international needs (see Figure 7). On the defense side, however, a war that only gets more expensive with time has pushed defense spending to record highs in 2008 (see Figure 7).

The budget assumes a sharp drop in military spending in 2009 and future years, but only by excluding all war costs beyond January 2009. Adding in all war costs in 2008 and 2009 will likely push budget deficits into record $500 billion territory.

In order to make room for substantial R&D funding increases, especially for the physical sciences, in a domestic discretionary budget that would barely increase, the President has proposed to eliminate more than 150 programs, including nutrition programs, health care grants, weatherization assistance, and $3 billion in education programs, and has proposed dramatic reductions in low-income heating assistance, state and local law enforcement grants, homeland security grants, job training grants, and other state and local block grants.

As in past years, it seems highly unlikely that Congress would grant 15 percent or more increases for some R&D programs while eliminating or slashing such politically popular health, education, and labor programs. So Congress once again faces tough dilemmas as it considers the President's budget.

The 110th Congress will no doubt try, as it did last year, to add to the overall pot of money available for domestic appropriations, but President Bush will once again dig in with promised and actual vetoes for any appropriations exceeding his request, a tactic that forced Congress to give up $22 billion in additional domestic spending for 2008.

President Bush will insist that Congress hold to his request for $988 billion in regular discretionary appropriations for 2009, an apparent $46 billion increase over 2008 but $45 billion of which would go to defense and other security-related spending. Congress may be successful this year in adding money to the request for domestic appropriations; but if not, then Congress will have a minuscule $1 billion or 0.3 percent increase to allocate for domestic non-security programs overall.

Within that total, moving money around to restore funding for the hundreds of programs proposed for steep cuts or eliminations will likely end any hopes for the ACI agencies to receive their full requested increases. Ironically, political budget battles of 2008 will likely focus on the tiny $1 billion requested increase for domestic spending, while policymakers in both parties and both branches will barely blink at the price tags of $200 billion in annual war costs on top of $537 billion in regular defense spending, a roughly $150 billion economic stimulus package, and approximately $50 billion for a one-year AMT patch for 2008.

The Democratic majority has already signaled that the President's request for domestic appropriations is once again inadequate. In the upcoming debate on the 2009 budget resolution, the congressional response to the President's budget, Congress will try to add money to the domestic appropriations total so that the Appropriations Committees can add money to individual programs later in the year.

But any appropriations bills based on the budget resolution will run into the President's veto pen if they exceed his request. Based on their actions in the 2007 and 2008 appropriations bills, appropriators appear poised to support the ACI increases in 2009 but only if additional domestic dollars are available. If President Bush succeeds in holding the line on domestic spending, then the ACI increases will be chiseled away to shore up funding for threatened domestic programs and to boost R&D requests in energy R&D, biomedical research, and environmental research. An additional complication this year is that President Bush leaves office in January 2009, so there could be a temptation for the Congress to postpone action on 2009 appropriations until a new President takes office in the hope that he or she will be more amenable to increasing domestic spending.

But that strategy would result in federal agencies spending months in limbo after the October 1 start of FY 2009 waiting for final action on appropriations, and may not result in any additional funding. So once again, the science and engineering community prepares for a long budget season with uncertain outcomes where promises of renewing federal commitments to basic research once again meet the budgetary realities of tight limits on domestic spending.

February 7, 2008

FOR MORE INFORMATION:
More materials on R&D in the FY 2009 budget, historical data and charts, and more information on AAAS Report XXXIII: Research and Development FY 2009, can be found on the AAAS R&D Web site at www.aaas.org/spp/rd. The information in this preliminary analysis will be continually updated with revised agency data, and revisions.)

AAAS R&D Budget and Policy Program 1200 New York Ave, NW Washington, DC 20005 (202) 326-6607 science_policy@aaas.org
http://www.aaas.org/spp/rd

New "Dual-Use" Export Control Initiative

The Administration has issued more guidance on its "validated end user" policy affecting exports of militarily sensitive or critical technologies abroad where such technologies might also be readily available from foreign source countries. The "validated end user" concept tries to accommodate the needs of U.S.-based exporters concerned about loss of foreign markets and erosion of U.S. competitive capacities ...

Fact Sheet:
Dual-Use Export Control Initiative

President George W. Bush announced on January 22, 2008 a series of steps the Administration will take to ensure that dual-use export control policies and practices support the National Security Strategy while facilitating U.S. economic and technological leadership. The United States faces unprecedented security challenges from threats of terrorism to proliferation of weapons of mass destruction and advanced conventional weapons to instability in a number of regions in the world. The United States also faces unprecedented economic challenges from the increasing worldwide diffusion of high technology and global markets. The United States must, therefore, ensure that the dual-use export control system is precisely focused to meet those challenges. To enhance the focus of the dual-use export control system, the President has directed steps be taken on the following:

Foreign End-Users: To adapt to the changing threat environment and the globalization of technology and markets, the dual-use export control system will increasingly focus on foreign end-users of U.S. high technology products. This focus will facilitate trade to reliable foreign customers, while denying access to sensitive technologies to proliferators, international terrorists, and other foreign parties acting contrary to U.S. national security and foreign policy interests.

The focus on foreign end-users includes the Validated End User (VEU) program for reliable foreign companies and imposing additional scrutiny of exports to foreign parties with a record of activities contrary to U.S. foreign policy and national security interests through expansion of the Department of Commerce's Entity List.

U.S. Competitiveness: Technological and economic competitiveness are key to the U.S.'s long-term national security. As such, the United States needs to ensure that export controls are constantly reassessed to ensure that the most sensitive items are controlled to sustain U.S. economic competitiveness and innovation.

The focus on U.S. competitiveness includes developing a regular process for systematic review of the list of controlled dual-use items (the Commerce Control List), revised controls on intra-company transfers, revised controls on encryption products, and a review of reexport controls.

Transparency: U.S. exporters need sufficient information to support U.S. security and competitiveness goals.

The focus on transparency includes publication of advisory opinions on the Department of Commerce's website, as well as lists of foreign parties warranting higher scrutiny.

ASTRA-CSIS Educational Series a Hit

ASTRA and the **Center for Strategic & International Studies (CSIS)** have conducted several recent educational programs at CSIS' Washington Headquarters.

Focusing on aspects of innovation policy, the events have attracted large numbers of people, including experts from the defense and international policy communities. The first event commemorated the **50th Anniversary of the Sputnik launch** on October 4, 1957.

The most recent program — Innovation and Education: Are we Investing Well? — featured a town hall in which expert panelists and the audience debated the focus and results of Science, Technology, Engineering and Mathematics education (STEM Ed) at all levels of the U.S. educational establishment since Sputnik.

The spirited discussion can be heard by clicking on ASTRA's **usinnovation.org** Web Site and accessing the program's .mpg file.

Additional programs are planned with CSIS on a quarterly basis or as the occasion arises. If you have ideas for future programs, please contact ASTRA's Bob Boege at r.boege@comcast.net

ASTRA

CSIS

Innovation and Education: Are we investing well?

Friday, January 18, 2008
9:00 a.m. – 11:30 a.m.
1800 K Street NW, Washington, DC
B-1C Conference Center (lower level)
Complimentary Registration

The National Academies "Rising above the Gathering Storm" devoted an entire chapter to "What Actions Should America Take in K–12 Science and Mathematics Education to Remain Prosperous in the 21st Century?" and concluded, "The competitiveness of US knowledge industries will be purchased largely in the K–12 classroom."

One thing that we do know is that education spending at the K-12 level has increased dramatically as our economy has shifted to one based on services and information. According to the US Dept of Education, constant dollar funding for public K-12 education has roughly doubled on a per-student basis during the 30 years from 1973 to 2003.

What is *uncertain* – and there are conflicting indicators – is whether this investment is achieving the objective. Are we ensuring that our education infrastructure is providing our children with the skills needed to compete in the 'flat world' that we have heard so much about? Put another way, are we getting the return on the education investment that we need to maintain the vitality of the US economy?

On January 18th, 2008, ASTRA and CSIS will sponsor a discussion that will critically examine the role of education in driving innovation. We will also review how well American students are doing relative to their peers in other nations. Our objective is to shed a little light on this highly complex area to find out where we appear to be doing well and where we need to consider changing to improve our education outcomes.

Session Agenda

9:00 **Opening Remarks:** ASTRA and CSIS
9:10 **Panel Discussion:**

Dr. Dennis Cheek – Vice President, Education,
The Ewing Marion Kauffman Foundation
Dr. Iris Rotberg – Co-Director, Center for Curriculum, Standards and Technology
The George Washington University
Dr. Kent Hughes – Director, Science, Technology, America, and the Global Economy
The Woodrow Wilson Center
Mr. Vivek Wadhwa – Executive in Residence
Duke University

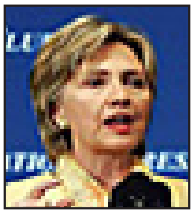
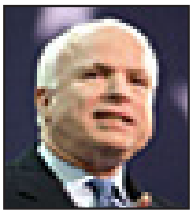
10:50 **Questions**
11:25 **Concluding Remarks**
11:30 **Adjourn**

To Attend: Please RSVP "YES" to arasmussen@csis.org by Friday, January 11, 2008. Please note that seating is limited and will be granted on a first come, first-served basis. Kindly tell us if you need any special accommodations to attend.

Above: Vivek Wadhwa of **Duke University** discusses engineering workforce metrics as (from left) **Dr. Iris Rotberg (George Washington University), Dr. Dennis Cheek (Kauffman Foundation)** and **Jim Lewis** of **CSIS** listen.

Above: Meg Hardon of **Qimonda** directs questions to the panel as participants in forum participate in wide-ranging discussion about measuring results of STEM Ed investments.

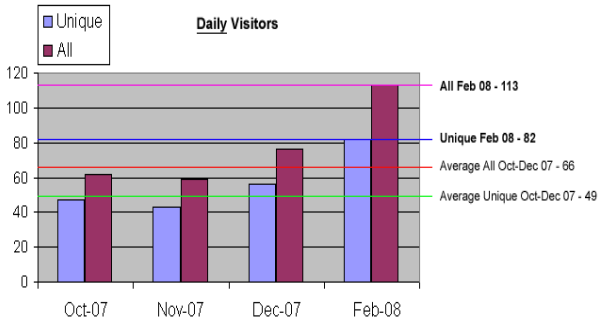
Update: Growing ASTRA'S "Virtual" Presence


Traffic Analysis for ASTRA's US Innovation.org

Results of Web Enhancements:
Comparison of October-December 2007 & February 2008

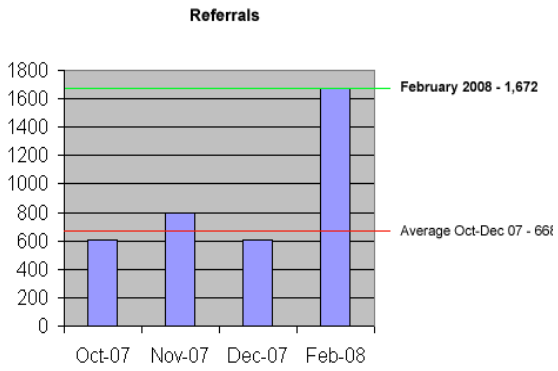
This report shows a comparison of web traffic between October-December 2007 time frame and February 2008. In an effort to increase traffic to **usinnovation.org**, several web enhancements and policies were implemented to the site during January 2008. The below charts and data shows the results of those efforts.



Visitors: The following chart shows the number of unique visitors and all visitors. Unique visitors are first-time visitors to the site. All visitors include unique as well as repeat visitors to the site. **Unique visitors were increased by 67%. All visitors were increased by 71%.**

Conversion Rate*:* Conversion rate is the ratio of first time visitors to repeat visitors. The goal is to convert first time visitors into repeat visitors, thus increasing the rate and increasing traffic. **The conversion rate increased from 35% to 38%.** This means for the month of February, of the 2,374 first time visitors who visited the site, 902 returned for repeat visits.

Referrals: Referrals indicate how visitors are finding usinnovation.org or where they are coming from. Referrals can be from search engines or other web sites. **Referrals have increased bv 150%. Google referrals have increased from an average of 122 referrals per month to 542. Referrals from ASTRA have increased from an average of 124 per month to 662.** This dramatic increase is most probably due to implemented link exchange policy and enhancements to site coding.



Popular Pages: Visits to the home page have remained relatively consistent since December 2007, although February visits of 1,763, are an all time high.

The most popular sections on the site continue to be the **Presidential Tracking and State R&D pages**. Visits to these pages have increased greatly. **Oct – Dec 2007 Average: 100 visits for each Feb 2008 Average: 500 visits for each — Increase of 400%**

Enhancements made to site in January 2008. • Registered site with search directories. Some of these directory services are used by the major search engines.

• Enhanced presidential campaign tracking section with more informative links. • Moved "Join Astra" link to top of page. • Added prominent graphic link on aboutastra.org to usinnovation.org • Enhanced meta and keyword tags on all pages. • Additional keywords added based on Go Daddy report showing common search words for site, such as voting, education, articles, competitiveness, etc. • Keywords should be limited to 30.

ASRA 2008 State R&D Sheets Now Available ...

ASTRA's popular State R&D Sheet series for 2008 is now available for free download from both ASTRA Web Sites: **www.aboutastra.org and www.usinnovation.org** The new series has added the District of Columbia to the rankings, and it has relied upon more "granular" data now available to us. R&D spending by top Congressional Districts and by contract size is also featured. The State Sheets were available for the March 4-5 Congressional Visits Day 2008 event earlier this year.

Tennessee R&D 2008

Meeting the Global Challenge for Innovation

America's innovation future requires more federal investment in basic scientific research. Overall scientific research and development (R&D) promotes economic development, job growth, national security, competitiveness and global leadership. America's innovation future requires more federal investment in basic scientific research. U.S. leadership continues to narrow across a broad range of indicators when compared to the rest of the world.

Basic or "frontier" research is primarily funded by the federal government for complex economic reasons. There is little or no incentive for the private sector to invest in frontier research because it is typified by high risk and low immediate reward. Yet, basic research benefits us all over a longer time period. It results in discovery, innovation and other end products and services — all derived from taxpayer investments in science. An estimated 73% of all patents granted in the U.S. are attributable to scientific research initially funded by taxpayers through the federal government, especially university research operations.

Tennessee contractors earned $345 million in federal R&D contract expenditures in FY 2007, with approximately 119 prime contractors involved. This amount *does not include federal grants and loans for R&D activities*. Information and charts on this page demonstrate the importance of federal investment in R&D to Tennessee's economy, and its future in the global marketplace.

U.S. Leadership Narrows Across Key Indicators: Declines Across the Board in Global Share

U.S. Share of Global Output

Federal Funding for Physical, Mathematical & Computational Sciences and Engineering as a Percentage of US GDP 1970 - 2005

Sources: Compiled by ASTRA from National Science Foundation, *Federal Funds for Research and Development* series. GDP data from the Bureau of Economic Statistics, U.S. Dept. of Commerce. R&D Figures are for Basic and Applied Research only. Development and R&D facilities are not classified by discipline. © 2007 ASTRA, The Alliance for Science & Technology Research in America.

R&D Funding at Top 5 Tennessee Colleges & Universities FY 2006 ($ thousands)*

University or College	Total R&D	Federal R&D
Vanderbilt U.	$376,893	$300,423
U. TN System Office	$240,379	$112,080
Meharry Medical C.	$32,878	$30,914
U. Memphis	$43,715	$15,964
TN State U.	$14,096	$10,216

Top 10 Recipients of Federal R&D Contracts Performed in Tennessee FY 2007*

AEROSPACE TESTING ALLIANCE	$261,641,175
VF CORP.	$34,211,445
ST JUDE CHILDREN'S RESEARCH HOSPITAL	$20,183,966
JACOBS ENGINEERING GROUP	$10,507,771
NUCSAFE, INC.	$9,973,134
ADVANCED CONSTRUCTION TECHNIQUES	$9,937,209
AMERICAN BRIDGE MANUFACTURING	$5,226,568
VEXTEC CORP.	$3,348,163
UNIVERSITY OF TENNESSEE	$3,006,474
ST JUDE HOSPITAL (related subsidiary)	$2,404,801

Top 5 Known Tennessee Congressional Districts Where Federal R&D Contracts Performed FY 2007*

Tennessee 4 (Lincoln Davis)	$273,420,470
Tennessee 5 (Jim Cooper)	$54,509,479
Tennessee 9 (Harold E. Ford Jr. / Steve Cohen)	$23,068,474
Tennessee 3 (Zach Wamp)	$13,889,955
Tennessee 7 (Marsha Blackburn)	$4,352,467

Top 5 Federally-Funded R&D Products or Services Sold in Tennessee FY 2007*

Other Research and Development — Management and Support (R&D)	$261,641,175
Services — Management and Support (R&D)	$34,413,368
Life Sciences — Basic Research (R&D)	$19,687,959
Construction — Basic Research (R&D)	$15,838,057
Defense Missile and Space Systems — Management and Support (R&D)	$10,498,771

Key Reports and On-line Resources:

- *ASTRA's* ***Riding the Rising Tide*** is a 14-Point Policy Framework for regaining America's scientific & technology lead. A comprehensive set of analytical tools and reports on innovation and R&D policy are also found at www.usinnovation.org and www.aboutastra.org, the two ASTRA Web Sites.
- The Science-Engineering-Technology Working Group (SETWG) sponsors the annual Congressional Visits Day Program. See www.setcvd.org/cvd2008/
- The American Chemical Society's Science Policy resource Site is www.acs.org
- *Science & Engineering Indicators 2008*, published by the National Science Board, provides a broad base of quantitative information on the U.S. and international science and engineering enterprise. See www.nsf.gov/statistics/seind08/

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Made possible by the American Chemical Society www.acs.org

...anks 2008

	Tennessee	Total U.S.
	6,156,719	302,045,000
	2,910	150,717
	$30,952	$34,495
	61,476	5,627,326
	$57,311	$75,501
	4,091	332,976
	$238	$13,149
	$540	$980
	— 8,524	— 955,703
	5.2%	4.6%
	1,950	27,974
	7,980	527,767
thousands)	$486,511	$30,033,156
thousands)	$64,384	$3,016,240
	$27,484	$2,427,627
	$124,607	$9,062,058
	$6,850	$8,701
tor)	.041	—
	26.86	50.86
	0.21%	1.58%
	$3,523	$424,869
	$518	—
	228	33,289
	$3.99	—
	$1,630	$201,131
	$726	$45,725
	0.10	—
	584	89,795
03	2.91	—
	— 90%	— 76%
	$47.0	$25,505
	— $13.6	$2,790
	9.32	10.0
	53.3	62.1

Overall State New Economy Index Score 2007

New Economy Index (measures 6 aspects of dynamism)

Sources: U.S. Department of Commerce, Bureau of Economic Analysis; U.S. Department of Commerce, Census Bureau; National Science Foundation-Science Resources Study Division; U.S. Bureau of Labor Statistics; National Venture Capital Association www.nvca.org; U.S. Patent & Trademark Office; U.S. Office of Management & Budget; U.S. Small Business Administration; Association of University Technology Managers, Inc., *AUTM Licensing Survey: Fiscal Years 2006-2006*; Ewing Marion Kauffman Foundation www.kauffman.org; Information Technology & Innovation Foundation www.itif.org.

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Made possible by the American Chemical Society www.acs.org

• Sources: The sources of this data include a variety of federal government agencies, including the U.S. Office of Management & Budget and the National Science Foundation.

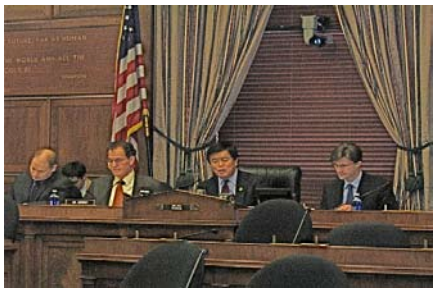
Testimony on NIST Budget March 11, 2008

Testimony Before the House Subcommittee on Technology and Innovation Regarding the National Institute of Standards and Technology (NIST)

by

Mary L. Good
Donaghey Professor and Dean, Donaghey College of Engineering and Information Technology
University of Arkansas at Little Rock

Chairman Wu and Members of the Subcommittee: It is a great pleasure for me to be able to testify on the behalf of NIST and its activities. I regard NIST, as does most of the technology community (including the technology based industry), as perhaps the most important national laboratory because of its relevance to the long-term success of American industry in the stimulation of innovation and contributions to the competitiveness of the American enterprise.



Above: ***Chairman David Wu (D-OR)*** *of the House Subcommittee on Technology & Innovation convenes NIST Budget hearing on March 11, 2008*

NIST has a long history of providing the standards for commerce which allow for an orderly and fair process for doing business, protecting the health of the population, and promoting best practices in the complex enterprise which is today's global economy. The value of NIST and its pervasive influence was brought home to me a few years ago when I was invited to South Africa as part of an international advisory group to review the South African Bureau of Standards and to provide the government with proposals for improvement. The work there could be defined as developing, institutionalizing, and monitoring everyday weights and measures used in everything from country stores to gasoline distributors to food processors to multinational companies manufacturing everything from automobiles to everyday household goods. The quality of transactions that we in the US take for granted were still being monitored and improved. Some of these activities in the rural areas of the country would have been NIST activities a hundred years ago!

The US public just assumes that commerce and regulatory activities will be carried out with consistency and be based on appropriate standards that can be verified if necessary. This complacency is possible because of the long history of NIST standards work including calibration and metrology science in all areas of our enterprise. The value of the government's role in these activities was first acknowledged by the Founding Fathers when they included in the Constitution the need to establish a system of weights and measures.

The establishment of the National Bureau of Standards in 1901 (NBS) gave this important government function to NBS. New responsibilities for direct industry interaction were added and NBS was renamed the National Institute of Standards and Technology in the 1980's. NIST continues the production and distribution of standards for all areas of commerce and modern life but it has now gone beyond these early responsibilities.

ASTRA's Chairman, ***Dr. Mary Good,*** *testifies as part of expert panel during NIST budget hearings, March 2008*

Today NIST is the premier laboratory for metrology research in the world with applications in all areas of emerging technologies like nanotechnology, biotechnology, and high performance computing. The quality of this work is epitomized by the receipt of three Nobel Prizes by NIST scientists in the last few years. In summary,

NIST is an American jewel that provides one of our advantages in a competitive global environment. Long term support for its programs should be an investment at a very high priority in our federal budget. However, NIST should be held to very high standards and should be expected to justify its

activities and prioritize its opportunities to play a significant role in the competitiveness initiatives in the *America COMPETES Act of 2007*. I have reviewed the President's proposed budget for NIST for 2009 and the planning document NIST provided to the Congress. The requested additional support for the NIST laboratories is certainly justified by the proposed new research activities outlined in their planning document. The facilities funding, particularly for the expansion and up-grade of the Colorado facilities, is long overdue. The world class research that takes place there deserves a world class facility.

However, the President's budget proposal to phase out funding for the Manufacturing Extension Program (MEP) and the new Technology Innnovation Program (TIP) is both short sighted and represents a misunderstanding of the value of these programs.

It is my assessment that this oversight is disastrous for the incentivization of innovation in small and medium sized enterprises and for NIST as it carries out its mandates for the support of cutting edge manufacturing technologies and the incentivization of new American companies utilizing emerging technologies. Two examples will be illustrative of these values.

Above: ***Chairman David Wu (right)*** *confers w. ASTRA member* ***Skip Rung,*** *Head of* ***ONAMI,*** *the* ***Oregon Nanoscience & Microtechnologies Institute****, as ASTRA's* ***Burk Kalweit*** *looks on.*

The National Academies convened a panel (I was a member of the panel) to review the National Nanotechnology Initiative funded through several government bureaus. Two of the findings were: (1) there are many (in the thousands) start-ups and early stage companies with potential products and processes utilizing nanoparticles and nanotechnology; and (2) the health and environmental effects of nanomaterials in the work place and in consumer products are not well understood.

These findings certainly justify the proposed NIST work on nano-manufacturing processes and the development of metrology and standards for nanomaterials. The question is how to effectively couple the NIST work to these businesses in emerging technologies.
The legislation renaming NBS contained the following directives: "to … modernize and restructure that agency to augment its unique ability to enhance the competitiveness of American industry while maintaining its traditional function …"; "to assist private sector initiatives to capitalize on advanced technology"; and "to advance, though cooperative efforts among industries, universities and government laboratories, promising research and development projects, which can be optimized by the private sector for commercial and industrial applications."

These directives were further endorsed by the *America COMPETES Act of 2007* where the Congress authorized MEP (with a proposed doubling of its budget over time) and TIP. How better to carry out the NIST mandate than coupling the MEP State programs with the NIST scientists who are developing these new manufacturing and metrology technologies?

Many research studies have shown that technology transfer is most efficient if the technology developers have a close relationship with the users. Thus NIST could create a model of tech transfer by educating the personnel in the State MEP centers about their evolving technologies and then challenge the State centers to catalog and reach out to the start-ups and early stage technology companies in their State.

The NIST scientists could both focus their efforts better and more rapidly see their efforts utilized by understanding the needs of these new companies in real time. Thus MEP represents a unique vehicle for a faster, better focused effort on NIST's part and the companies have the benefit of the early adoption of NIST standards and manufacturing technologies. This provides a win-win success for NIST, the companies, and American competitiveness.

A similar argument can be made about TIP. TIP was authorized in the *America COMPETES Act* to "support, promote, and accelerate innovation in the United States through high-risk high-reward research in areas of critical national need." The mechanism to carry out this mandate was the establishment of a program of competitive grants for partial funding of small or medium size enterprises via contracts, collaborative efforts with universities, etc.

Testimony on NIST Budget March 11, 2008

Again, if NIST is to carry out its mandate for aiding the private sector in moving successfully to new, promising technologies, what better vehicle than interacting with real companies which are trying to turn technology into commercial projects and processes.

The NIST experience with ATP clearly demonstrates their ability to propose and effectively manage a grants/contracts program as outlined in the TIP authorization legislation.

Thus I see the President's budget initiative to eliminate MEP and to not establish TIP, very short sighted and an example of not understanding what NIST gains from these programs and how important they are for the US to stake out leadership in the commercialization of the new and emerging technologies where we have funded much of the underlying fundamental research.

These two programs can be very instrumental in the successful start-ups in nanotechnology, biotechnology, high performance computing (including light-scale communications), hydrogen fuel, and quantum computing.

With respect to the NIST Three-Year Programmatic Plan, it describes NIST's value in the US enterprise, its processes for internal quality reviews, and the programs they plan with additional funding the 2009 budget provides for the laboratories. However it is not a usual "strategic" plan.

For example, they point out that the programs they plan to focus on are: "address critical national needs and measurement barriers to innovation; improve the capacity and capability of the NIST laboratories; and form new and strengthen existing partnerships with industry and academia." The plan, if you include the Appendices to the report, does a good job of the strategy pertaining to maintaining the NIST laboratories but the plan does not provide a strategy for determining national needs or how to make a significant increase in industry and academic ties.

A strategic review and prioritization of the national needs results would then inform the planning for the laboratories. Recently the **ASTRA (Alliance for Science and Technology Research in America) Legislative Task Force** released a report entitled "Riding the Rising Tide: ASTRA's Strategy for Enhancing US Competitiveness and Prosperity."

This report, which was contributed to and vetted by several scientific and engineering societies, several industry partners and several academic institutions, proposed a 14-point Innovation Action Agenda for the US. The 14 points can be divided into three strategic areas: Federal Funding of R&D; workforce and STEM education; and a business climate that supports innovation. NIST clearly has a major role in the federal research efforts but it also has the opportunity to play a role in assuring an "innovation agenda" for US based industry.

Thus the NIST forward plan should include insight beyond just next year's budget constraints. It would have been helpful if they could have correlated their forward plan to the overall innovation agenda so that they stake out their opportunities and responsibilities for a major impact on the rate and quality of innovation in the United States. Such a longer term strategic view would then maximize their opportunity to guide the budget process rather than having the yearly budgets guide their activities. I would have also liked some detailed discussion of the Baldrige National Quality Award program although it is a small portion of the budget. This program has the opportunity to disseminate best practices in businesses, health, and education. It should be integrated into the overall push for innovation in these sectors.

Clearly, in the limited scope of this hearing and the time available, it was not possible to comment on all of the facets of the NIST activities. So, in summary, let me say that the attention to, and planning for, accelerated innovation in the US enterprise is the most important part of any plan to maintain US competitiveness.

Other factors are important, but without innovative new companies and the ability of established businesses to continue to change and innovate, the US outlook for providing a high quality of life for its citizens gets much less positive. NIST is an important link in this plan for the future and a significant investment in both their internal and external activities is a must investment from the federal budget.

*Above from left: ASTRA member **Skip Rung,** Head of **ONAMI,** the **Oregon Nanoscience & Microtechnologies Institute**, **ASTRA Executive Director Bob Boege**, and **Dr. Mary Good** take a lunch break prior to testimony on March 11.*

ASTRA's Legislative Task Force Mobilizes S&T Community

ASTRA's Legislative Task Force Co-Chairmen 2008

Emily Baker
National Venture Capital Assn.

Scott Cooper
American National Standards Institute (ANSI)

Gordon Day
Optoelectronics Industry Development Assn. (OIDA)

John Kania
Applied Materials

Ronald Kelley
Materials Research Society MRS)

Laura Kolton
Optical Society of America (OSA)

Jeanette Morgan
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William Morin
Applied Materials

Christopher Mustain
IBM Corporation

Frank Orlandella
Agilent Technologies

Anthony Pitagno
American Chemical Society

Deborah Rudolph
IEEE-USA

Judy Sherman
American Dental Assn.

Meredith Singer
IBM Corporation

Ian Steff
Semiconductor Industry Assn.

***Above:** **Melissa Shannon** serves as **Senior Policy Advisor** for **Speaker of the House Nancy Pelosi (D-CA)** and met w. ASTRA LTF delegation on science funding topics at the beginning of this year's Session of Congress.*

The Task Force meets at ASTRA member organization offices, or via teleconference. The frequency of meetings varies with the Congressional schedule and the legislative cycle.

ASTRA's Legislative Task Force (LTF) was created in 2001 to educate Members of Congress and the Administration on a variety of topics related to science funding and the importance of investing in basic scientific research for the physical and mathematical sciences and engineering.

In February, 2001 the first of what would become thousands of Hill visits began. Over the years, the Task Force has steadfastly shared political intelligence, devised strategies, and tried to motivate many other groups to get involved in making a case for increased spending on scientific research and development funding.

ASTRA's LTF operates informally, through volunteers. It has a larger network of about 120 other organizations which often share its interests. The LTF is among the pioneer organizations which supported doubling the National Science Foundation budget in 2001 and 2002. It then turned its attention to the **National Innovation Initiative** and what would become the ***America COMPETES Act*** in 2003-2004. The LTF is comprised of volunteers from industry, membership organizations and academe.

During 2008, the LTF is being directed by a volunteer force of 12 Co-Chairmen, listed above. ASTRA has, on average, issued 1-2 legislative ***Action Alerts*** per month for the past several years.

The LTF assists in helping other organizations understand science funding and creating networks within state and metropolitan regions.

Approximately 7,000 individuals are now on the ASTRA List Serve and are occasionally asked to help in LTF activities.

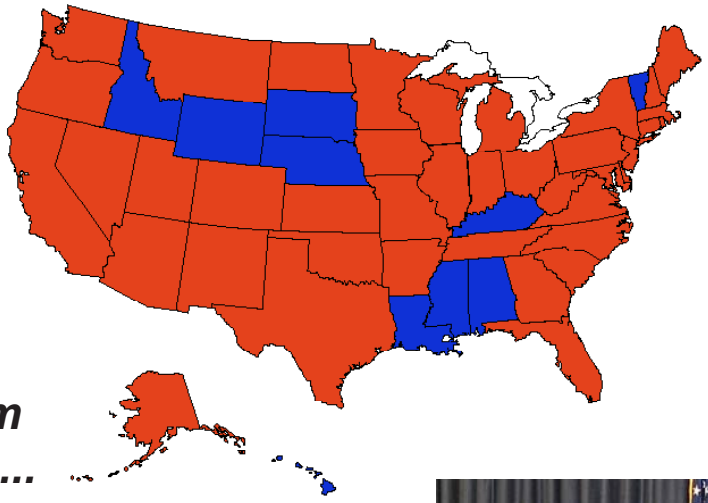
***Foreground and then left: Anthony Pitagno (American Chemical Society), Laura Kolton (Optical Society of America), Ron Kelley (Materials Research Society), Meredith Singer (IBM)** and **Christopher Mustain (IBM)** discuss legislative strategies and share information about Hill developments at recent LTF meeting.*

Congressional Visits Day 2008 a Success

386 Meetings ...

in which 230 scientists and engineers ...

visited Members of Congress from 40 States *(in Red)* ***...***



Above: CVD '08 Briefing Session t*ook place during the afternoon of March 4. Hosted by the* ***American Association for the Advancement of Science****, the event provided information about the current budget situation, legislative priorities and tips on making Hill visits. Representatives from both parties — from the Hill and the Administration — addressed the group as well.* ***Below:*** *Members of the* ***SET Working Group****, who met regularly since Summer of 2007 to organize this years event, meet at* ***IEEE-USA*** *Headquarters in Washington, D.C.*

Above: Rep. Bart Gordon (D-TN) *receives the* ***George E. Brown, Jr. Award f****or service to the nation's scientific, technology and engineering communities from* ***IEEE-USA President Dr. Russ Lefevre*** *during the CVD '08 Congressional Reception held March 4 on Capitol Hill.*

Above: Rep. Rush Holt (D-NJ) *a prior recipient of the Brown Award, joins in congratulating Rep. Gordon and thanking the crowd for their participation in CVD '08. Rep. Holt is a physicist and former Director of* ***Princeton University's Plasma Physics Laboratory.***

Congressional Visits Day 2008 a Success

Above: *Members of* ***SPIE — the International Society for Optics and Photonics,*** *conducted a morning Orientation Session at the University Club of Washington prior to heading over to the AAAS afternoon Briefing site.* ***Below:*** *CVD '08 participants got a chance to visit with the* ***Acting Director*** *of the* ***National Institute of Standards & Technology (NIST), Dr. James Turner.***

Above: *Going too far? When asked what they were doing, they yelled: "Bob said to practice our 'elevator speech" — so we are!"*

Above: ***SPIE's Arizona Team*** *meets with science staff during the March 5 CVD '08 event.*

Above: *Delegation from Arizona meets in the only office available — a Cannon Office Building garret — as scientists and engineers swarmed the Hill on March 5.*

Above: *Joint meetings in the corridors!* ***CCR, AVS, and IEEE-USA*** *members join forces to persuade staffers.*

Congressional Visits Day 2008 a Success

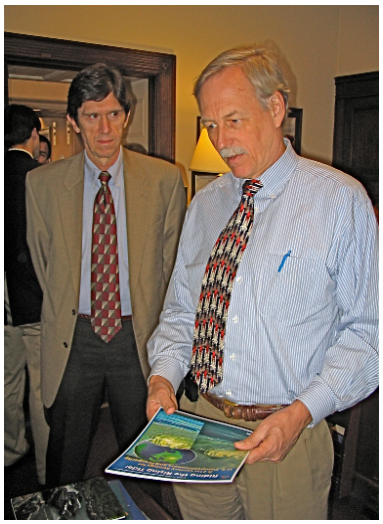
***Above:** **Dr. Rudolph Ludeke, Past President** of **AVS** and former **IBM Yorktown Research Center** official, meets w. **Rep. Vern Ehlers (R-MI), Ranking Member** of the House Science & Technology Committee.*

***Above:** Who says they can't get along? Rep. Ehlers congratulates **Rep. Bart Gordon** for his receipt of the **George E. Brown, Jr. Award** during reception held March 4 in the Rayburn House Office Building.*

***Above:** Delegations from the **American Chemical Society** and the **IEEE—USA** plot strategies for the next day's Hill Meetings during the Award Reception March 4.*

***Right: ASTRA's Burk Kalweit** presents **Rep. Vic Snyder (D-AR)** with a copy of the **ASTRA "Riding the rising Tide" Policy Framework** document.*

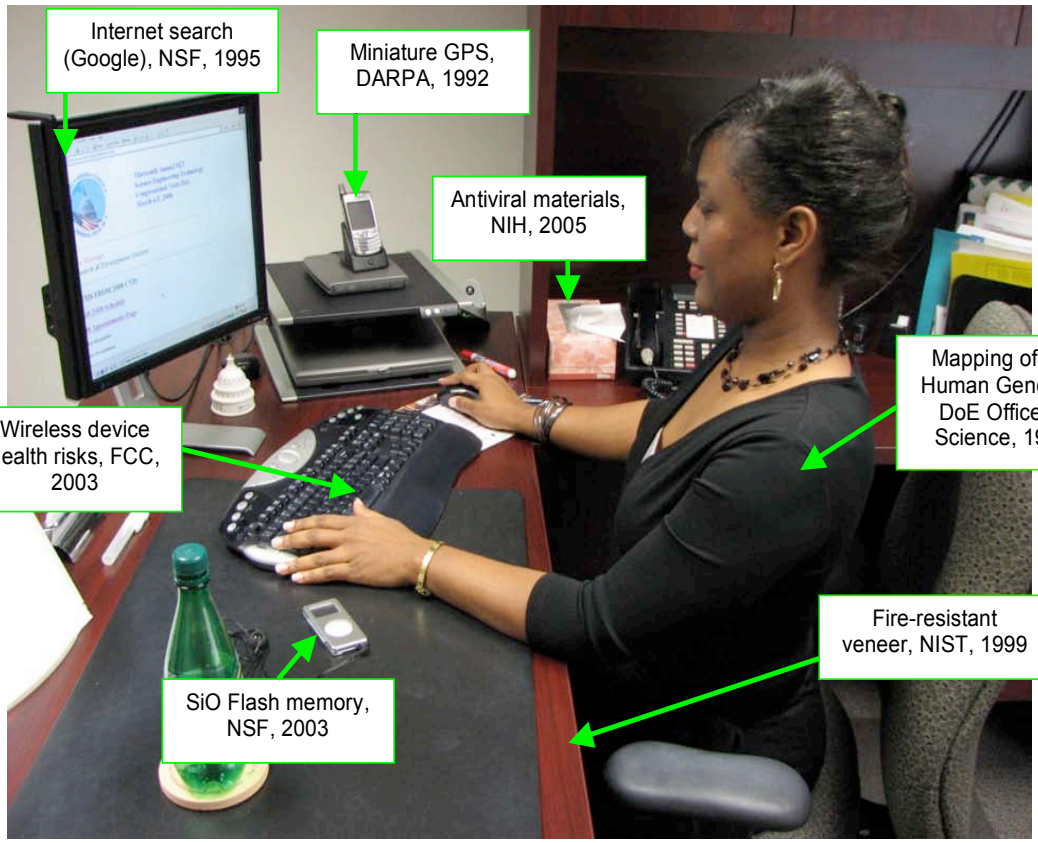
Many of the CVD '08 meetings took place several days before or after the March 5 official visit date.



Above:** About 200 scientists, engineers, Members of Congress and their staff attended the **George E. Brown, Jr. Award Reception.

***Above:** **Former Chairman** of the **House Science Committee** (now "S&T") the **Hon. Sherwood Boehlert,** addressed the Breakfast event March 5. He is greeted by **Dr. Catherine Hunt, President** of the **American Chemical Society** and **ASTRA Board Member** and an unidentified participant.*

Federally-funded research... in Your Daily Life



Did you use your tax dollars today? Of course you did!

Federally funded research has brought innovations as diverse as sunblock and mp3s into the lives of every American, yet funding for R&D increased by approximately 1 percent in FY2008. Privately funded research is unable to make up the difference needed for advancement, and U.S. competitiveness in science and technology is in jeopardy.

Please support strong R&D funding for FY2009.

...American economic leadership is fueled by national investments in an educated and skilled workforce, groundbreaking federal research, and a steadfast commitment to being the most competitive and innovative nation in the word.

– Speaker Nancy Pelosi, December 19, 2007

To keep America competitive into the future, we must trust in the skill of our scientists and engineers and empower them to pursue the breakthroughs of tomorrow.

– President Bush, State of the Union address, January 28, 2008

Summary of

The Technology Imperative

by Gregory Tassey
published by Edward Elgar, 2007

The essence of *The Technology Imperative* is a characterization of the global economy's transition from a U.S.-dominated monolith to one in which the dynamics of technology-based competition arise from a multi-source, multi-market structures with dramatic implications for national economic growth policies.

The long dominant Schumpeterian model of "creative destruction" in which new technology is assumed to appear periodically from largely unspecified sources to "disrupt" existing industries is replaced by a "public-private asset" model in which the process of technological change is an explicit part of the policy tools for managing economic growth.

In such a model, governments become critical actors not just in advancing the science base but also in proving new technology concepts and supplying a range of critical technical infrastructure that attract investment capital to the domestic economy. This model is evolving worldwide. However, it is still in its infancy as governments experiment with different R&D and technology utilization investment incentives.

The driving force behind the transition to this new model of technology-based economic growth is an evolving corporate strategy paradigm in which all three major asset categories – R&D, manufacturing, and marketing – are now truly global. The term "global" implies an evolutionary step in corporate strategy beyond "multinational". Multinationals offshored manufacturing and marketing, but much R&D (especially the breakthrough type that is the essence of the creative destruction process) remained in the home country. However, global companies partner as much with foreign-based companies as with domestic ones and they respond strongly to investment incentives all over the world, including forming partnerships with governments to develop disruptive technologies. IBM, Microsoft, Intel and many others are as likely to invest in breakthrough research in Europe or Asia as in the United States.

Globalization of corporate strategies is an attempt to manage the technology life cycle and thus survive the creative-destruction process. As a result, competition among uniquely domestic industries across national economies has become an anachronism. The mobility of financial and intellectual capital is putting increasing pressure on national governments to create and maintain innovation infrastructures that, in effect, "tilt" the flattening world in favor of their domestic economies.

Competition among governments therefore is becoming an important factor in determining domestic market shares within the global economy and thus which economies win and which lose in the increasingly intense process of technology-based competition. Yet, while other nations continue to raise their R&D intensities and invest in more efficient and broad-based R&D support mechanisms, U.S. R&D intensity is still below its peak reached in the mid-1960s and investment in technology clusters, education and other infrastructure is struggling to keep up with similar initiatives in Europe and Asia.

This "other infrastructure" is particularly misunderstood and hence inadequately supported. The intense battle for global competitive position is increasingly affected by differences across economies in a complex and ubiquitous set of infratechnologies (measurement methods, process-control techniques, and science and engineering data). Every technology currently driving the global economy is supported by such infrastructure.

These trends imply that R&D efficiency will become one of the more important differentiators. In spite of the frequently cited global dispersion of R&D, "co-location" of complementary R&D assets and subsequent innovation efforts is actually becoming more important due to the increasing scientific basis and complexity of emerging technologies.

These characteristics raise the importance of so-called "tacit knowledge" transfers, which research shows are still executed best by person-to-person contacts. It is the importance of tacit knowledge transfers that has helped drive the proliferation of technology clusters all over the world.

In analyzing these issues and their policy implications, the first part of *The Technology Imperative* describes the ongoing process of globalization of the technology-based economy supported by data from a wide variety of sources.

Dr. Greg Tassey, Chief Economist** at **NIST,** has also been a volunteer member of the **ASTRA Research Task Force** for the past five years ... Those interested in his book will find purchasing information on **page 25.

New Book Reviewed: *The Technology Imperative*

The evolution of both corporate strategies and government policies in response to the growing dominance of technology as a competitive asset is detailed.

In the second part, conceptual frameworks are devised to identify the causes and impacts of underinvestment within national economies and to describe how growing global competition is raising the costs of poor national policy choices. Without such models, policy development will continue to be largely guesswork.

Finally, the third part assesses national technology investment strategies and shows how S&T policies should be rationalized in economic terms so that they may be implemented and efficiently managed to create competitive advantage.

Currently, the two major policy mechanisms for supporting R&D investment, tax incentives and direct funding, are poorly understood and ineffectively applied. For example, the basic structure of the U.S. R&E tax credit has been tinkered with but hardly questioned while remaining "temporary" for 26 years (renewed 13 times).

Meanwhile, this incentive has had no detectable effect on the composition of industry R&D (its original objective) and tax expenditures amount to only 4 percent of industry-funded R&D, resulting in inadequate leverage for the much needed increase in U.S. R&D intensity.

Direct funding has been equally mismanaged as a result of adherence to the "black-box model", which results in such programs being caught up in "corporate welfare" attacks and frequent inappropriate focal points in the R&D cycle. Proposals for using or changing these mechanisms have not embodied the economic analysis required to make convincing cases and thereby overcome past biases and misunderstandings.

The evolution of new technology-based growth models will require changes in (1) the static model of industrial technology to incorporate the several major technology elements that respond to distinctly different investment incentives and (2) the dynamic model in order to address the factors determining competitive position over the entire technology life cycle.

These factors are several, spanning R&D investment, education, intellectual property rights management, and a wide variety of technical infrastructure and associated standards that significantly affect the relative cost of managing a high-tech supply chain across competing economic systems. Yet, such complexity is being met by a dismantling of what little science, technology, innovation, and diffusion (STID) policy capability exists in the federal government.

The bottom line is that while analysts have correctly characterized the "flattening" of the world in terms of the spread of the capability to compete in the global marketplace on the basis of technology, the major adaptations needed in economic growth policies have not been forthcoming.

The central realization that the global competitive environment can be tilted in favor of one domestic economy over another through public-private investment strategies (STID policies) is only slowly sinking in.

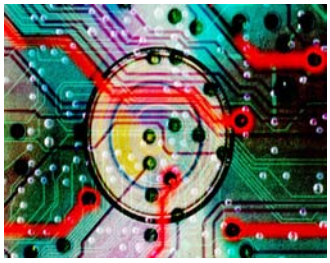
With corporations becoming global in all categories of investment, governments are now critical players in creating technology platforms and inducing private investment in complementary innovation assets that will reside within the domestic economy and thereby increase its competitive position.

One of the many incorrect postulates currently guiding technology-based growth policies is the belief that intangible assets in general and technical knowledge in particular diffuse rapidly. However, knowledge comes in different forms (such as varying degrees of embodiment in people, machines, and institutions). Some forms diffuse more slowly and embody different degrees of tacit and codified knowledge. Thus, a driver of economic growth policy should be to emphasize investment in the more immobile assets.

Among the critical categories of assets, skilled labor and innovation infrastructure are the least mobile. However, while the need for expansion and upgrading of the S&E labor pool is a relatively understandable imperative, the concept of innovation infrastructure and its several efficiency factors is complex. Hence, it presents a particularly difficult challenge for policy.

In summary, the United States has been the "first mover" in every major technology since World War II. However, it has achieved such leadership in spite of relatively inefficient R&D strategies and, in recent decades, outright neglect of the need for new policy algorithms. Such success has been possible only because of the lack of significant foreign competition.

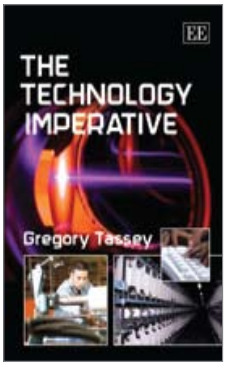
That era has ended. The next major wave of creative destruction, nanotechnology, will be the first emerging technology to exhibit broad and diversified competition among many technology-based economies. The U.S. economy will, for the first time, have to struggle to be one of the leaders.



NEW TITLE FROM EDWARD ELGAR PUBLISHING

The Technology Imperative

Gregory Tassey, Senior Economist, National Institute of Standards and Technology, US



'Page after page, this book builds a case of a major international transformation that has left the world economy much more dependent on science-driven technology. [The book's] arguments should attract attention and deserve to be discussed widely and thoroughly.'

– Nicholas S. Vonortas, The George Washington University, US

'The innovative models, supporting data, and unique policy analyses make this book a must for economists, policy analysts, and industry managers concerned about S&T policies and economic growth. It could easily end up as a definitive work on the modern technology-based economy.'

– Albert N. Link, University of North Carolina, Greensboro, US

The convergence of technology-based competitive capabilities among the world's economies has drastically altered the required economic growth strategies in industrialized nations. Based on a variety of corporate and government investment trend data and comparisons among national growth strategies, Gregory Tassey examines how this convergence has created an imperative for new growth models and strategies. In particular, he analyzes the major policy mechanisms for stimulating R&D investment and improving R&D efficiency over technology life cycles, detailing the needed changes.

In the 65 years since Joseph Schumpeter's classic characterization of the 'creative destruction' process of industrial technological change, the role of technology in economic growth has grown relentlessly. The author provides the first detailed assessment of underinvestment in R&D and the two major R&D policy response mechanisms – tax policy and direct funding. The policy models and analyses presented are based largely on US economic experience, but the resulting prescriptions are relevant for all existing and emerging technology-based economies. The author's ultimate message is that the industry-centric Schumpeterian model must be expanded to one in which competition among governments is as important as it is within the private sector.

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RIding the Rising Tide Policy Framework Promoted

In A Nutshell: ASTRA's 14-Point Action Program

December 11, 2007 Press Briefing for launch of *Riding the Rising Tide: A 21st Century Strategy for U.S. Competitiveness and Prosperity* in the House Science & Technology Committee Hearing Room on Capitol Hill. From right: Rep. Bart Gordon (D-TN), Chairman of the House Committee on Science & Technology commends ASTRA's multi-year efforts while Rep. Phil Gingrey (R-GA), Ranking Member of the Committees's Subcommittee on Technology & Innovation and ASTRA Board Members listen.

R&D ENTERPRISE

- Balance defense/civilian share of Federal R&D Portfolio
- Increase Federal funding for physical sciences and engineering R&D
- Focus R&D on the leading edge of science and technology
- Increase focus on interdisciplinary and multi-disciplinary research, new forms of collaboration, and nurturing capacity in new geographic regions.
- Provide incentives to capture benefits of public R&D within U.S.

INNOVATION WORKFORCE

- Examine adequacy of skills for innovation economy; educate for non-rule based, judgment-oriented problems
- Improve statistical and career information for STEM workers; companies should articulate skill needs to educators and students
- Improve higher education for scientists and engineers by focusing on global and cultural awareness, communications, business and management skills
- Strengthen efforts to attract and retain top foreign students and STEM professionals

PRO-INNOVATION BUSINESS CLIMATE

- Review U.S. laws, regulations and policies to determine impact on innovation; address inhibitors.
- Develop innovation indicators and metrics for knowledge-based economy; use indicators to drive policy and strategy.
- Create and provide support for better government analysis of U.S. and foreign innovation systems.

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